

WHAT IS CLAIMED IS:

1. A light emitting device comprising:
a substrate;
an n-type semiconductor layer;
5 an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;
a p-type semiconductor layer in electrical contact with said active layer; and
a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a layer of silver having a thickness sufficient to reflect
10 greater than 50% of light incident thereon, wherein a portion of said generated light exits said device through said substrate after being reflected from said p-electrode, and wherein said p-electrode further comprises a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver.
2. The light emitting device of Claim 1 wherein said n-type semiconductor layer and
15 said p-type semiconductor layer comprise group III nitride semiconducting materials.
3. The light emitting device of Claim 1 wherein said silver layer is greater than or equal to 20 nm in thickness.
4. The light emitting device of Claim 1 wherein said p-electrode further comprises a fixation layer overlying and in electrical contact with said layer of silver.
- 20 5. The light emitting device of Claim 4 wherein said fixation layer comprises a metal.
6. The light emitting device of Claim 5 wherein said fixation layer comprises a metal chosen from the group consisting of nickel, palladium, and platinum.
7. The light emitting device of Claim 1 wherein said p-electrode further comprises a
25 dielectric fixation layer overlying said layer of silver.

8. The light emitting device of Claim 7 wherein said fixation layer comprises a compound chosen from the group consisting of TiO_2 and Al_2O_3 .
9. The light emitting device of Claim 1 wherein said bonding layer comprises a metal chosen from the group consisting of gold, nickel, aluminum, and indium.
- 5 10. The light emitting device of Claim 1 wherein said bonding layer covers less than half of said layer of silver.
11. The light emitting device of Claim 1 wherein said bonding layer is a multi-layered structure.
- 10 12. The light emitting device of Claim 1 wherein said p-electrode further comprises a diffusion barrier layer between said bonding layer and said layer of silver, said diffusion barrier layer providing an electrical path between said bonding layer and said layer of silver, said diffusion barrier layer for preventing constituents from said bonding layer from interdiffusing with said layer of silver.
- 15 13. The light emitting device of Claim 12 wherein said diffusion barrier layer comprises a metal.
14. The light emitting device of Claim 13 wherein said diffusion barrier layer comprises nickel.
15. The light emitting device of Claim 12 wherein said diffusion barrier layer encapsulates said layer of silver.
- 20 16. The light emitting device of Claim 12 wherein said diffusion barrier layer is a multi-layered structure.
17. The light emitting device of Claim 1 further comprising:

an n-electrode comprising a layer of electrically conducting material in electrical contact with said n-type semiconductor layer; and

a package having first and second conductors thereon electrically connected to said p-electrode and said n-electrode, respectively.

5 18. A method for fabricating a light emitting device comprising:

forming an n-type semiconductor layer;

forming an active layer in contact with said n-type semiconductor layer, said active layer generating light by the recombination of holes and electrons therein;

10 forming a p-type semiconductor layer in contact with a surface of said active layer opposite a surface contacting said n-type semiconductor layer;

forming at least a layer of silver on said p-type semiconductor layer; and

forming a bonding layer overlying said layer of silver for making electrical connections to said layer of silver.

15 19. The method of Claim 18 wherein said n-type and p-type semiconductor layers comprise group III nitride semiconducting materials.

20. The method of Claim 18 wherein said n-type semiconductor layer is formed on a substrate.

21. The method of Claim 18 further comprising forming a fixation layer overlying said layer of silver.

20 22. The method of Claim 21 wherein forming said bonding layer comprises depositing said bonding layer on said fixation layer.

23. The method of Claim 22 wherein said fixation layer comprises a dielectric.

24. The method of Claim 23 wherein said dielectric is chosen from the group consisting of TiO_2 and Al_2O_3 .

25. The method of Claim 22 wherein said fixation layer comprises an electrically conducting layer.
26. The method of Claim 25 wherein said electrically conducting layer comprises a metal chosen from the group consisting of nickel, palladium, and platinum.
- 5 27. The method of Claim 18 wherein said bonding layer comprises a metal chosen from the group consisting of gold, nickel, aluminum, and indium.
28. The method of Claim 18 wherein said forming said bonding layer comprises forming said bonding layer to cover less than half of said layer of silver.
29. The method of Claim 18 wherein said forming said bonding layer comprises
10 forming a multi-layered bonding layer structure.
30. The method of Claim 18 further comprising forming a diffusion barrier layer between said bonding layer and said layer of silver, said diffusion barrier layer providing an electrical path between said bonding layer and said layer of silver, said diffusion barrier layer for preventing constituents from said bonding layer from interdiffusing with
15 said layer of silver.
31. The method of Claim 30 wherein said diffusion barrier layer comprises a metal.
32. The method of Claim 30 wherein said diffusion barrier layer comprises nickel.
33. The method of Claim 30 wherein said diffusion barrier layer is formed to encapsulate said layer of silver.
- 20 34. The method of Claim 30 wherein said forming said diffusion barrier layer comprises forming a multi-layered diffusion barrier layer.

35. The method of Claim 18 further comprising annealing said p-type semiconductor layer and said layer of silver by heating said light emitting device to a temperature greater than 200°C.

36. A light emitting device comprising:

- 5 a substrate;
an n-type semiconductor layer;
an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;
a p-type semiconductor layer in electrical contact with said active layer; and
10 a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a substantially transparent layer of silver, and wherein said p-electrode further comprises a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver.